

Corner: UNEP/SETAC Life Cycle Initiative

Report on Activity of Task Force 1 in the Life Cycle Inventory Programme: Data Registry – Global Life Cycle Inventory Data Resources

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DOI: <http://dx.doi.org/10.1065/lca2006.06.255>

Abstract

Goal, Scope and Background. Task Force 1 of the UNEP/SETAC Life Cycle Initiative prepared a report on the available Life Cycle Inventory (LCI) databases around the world. The group also aims to capture the global status of LCA through the report.

Results. An update of a previous summary prepared in May 2002 (Norris and Notten 2002), the global LCI resources report identifies LCI databases including public and proprietary, or restricted-access, databases. It includes descriptions of activities that aim to develop publicly-available databases in Africa, the APEC region and Asia, Europe, and the Americas (Canada, USA and Latin America). Because of their close association with the distribution of LCI data, LCA software programs that contain inventory data are also included in this effort. The report also lists institutions or organisations that provide LCI data in a less formal way, as this is important to get a feel for the global spread of LCI data. Also with the aim of facilitating access to global LCI data resources, the report provides information on regional LCA networks and societies. The focus of the report is on LCI databases and LCI data providers. It therefore does not list general environmental or process data sources (i.e. data must be in the form of life cycle inventories), nor does it list institutions working solely with LCA methodology development.

Discussion. The LCI data resources are summarised in the report in a series of tables. One table provides an overview of the global spread of LCI data resources, and essentially provides a top-level summary of the subsequent tables, whilst another lists LCA societies and networks. Other LCI databases are listed in the report in four tables, including national database projects, industry databases, other data sources, and LCA software. The appendix presents brief descriptive paragraphs of all the data sources and organisations mentioned in the report.

Recommendation. The full report is available upon request from the Task Force via Mary Ann Curran; readers are asked to provide updated or additional information that will improve the accuracy of the report.

Keywords: Databases; global; LCA resources; LCA software; LCI data resources, life cycle inventory

Publicly-Available Database Development Efforts at the International Level

The following discussion is a summary of the findings of the Data Resources report on the global activities related to LCI development by region.

Africa

With South Africa a major exporter of raw materials, the external demand for life cycle inventory data from South Africa is increasing (Brent et al. 2002). There is increasing potential for greater coordination of LCA efforts in South Africa. Although a few South African universities and research institutes have been active in LCA for over ten years, South African industry and government have been slow to realise the benefit of LCAs.

In developing countries in general, LCA capacity is low, and interest from industry and government is typically also low. LCA activity is usually only at an academic or research institute level. As many of these countries supply resources to developed countries, there is increasingly the recognition that LCI databases need to include the products and services from developing countries.

APEC Region and Asia

The need to develop a public LCA database with data applicable to the Asia Pacific region has been identified, and initial moves toward achieving this have been taken, driven largely by Japan. LCA activities in the region have been promoted by a series of symposia focusing on capacity building; the most recent meeting was held in Bangkok, Thailand, in December 2005 (MTEC 2005). The need for an international LCA forum of APEC member countries was identified in these symposia, to encourage collaboration and to share LCA skills between developed and developing countries, with the ultimate aim of developing an international database for the region. An initial step has been to develop an LCA researcher's network (Sagisaka 2002), as a precursor to an LCA forum. In 2000, the Japan Environmental Management Association for Industry (JEMAI) launched a project with Australia, Indonesia, Korea, Malaysia, Singapore, Taiwan, and Thailand to exchange information and to develop LCI data in cooperation with these countries on energy and a few basic materials (Sagisaka and Inaba 2003).

Japan

In Japan, progress in LCA has been significantly catalysed by the National LCA Project, which was started by the Ministry of International Trade and Industry (MITI) in October 1998. The project is run with the participation of industry, government, research institutions and academia, whilst

JEMAI is the secretariat for the project. The project has developed a publicly available, reliable LCA database to advance LCA methodology and practice throughout Japan. (Inaba and Kabayashi). LCI data for average Japanese production of a variety of materials are prepared by Japanese industrial associations, whilst calculations based on Input/Output tables, statistics, and process models are used to fill in data gaps. The database is available via the web to parties who pay a required membership fee (Inaba and Grant 2003). However, the database is released only in Japanese.

Australia

In Australia, a number of research institutes, consultants and industry associations have developed LCI databases. However, as yet, only that developed under the auspices of the Australian Life Cycle Inventory Data Project (a collaborative effort by the Centre for Design at RMIT, the Centre for Water and Waste Technology at the University of New South Wales and the Cooperative Research Centre for Waste Management and Pollution Control) has been made publicly available. In this project Australian LCI data sets have been developed for various plastics, glass bottles, aluminium, steel, timber, paperboard, concrete, electricity and heat from various fuels, and a variety of transport processes. The data sets are developed from the best Australian data available, supplemented with information from overseas data sets where necessary. Reports from this project plus updated inventories are available on the internet (RMIT 2003). LCA activities in Australia are becoming increasingly co-ordinated, with the establishment of the Australian LCA Society (ALCAS). ALCAS is currently in the process of developing a data collection protocol for a National LCI database which is planned to be hosted and supported by the Australian Commonwealth Scientific and Research Organisation (CSIRO).

Korea

Korea has supported two LCI database construction projects; one is supported by the Ministry of Commerce, Industry and Energy (MOCIE) while the other is supported by the Ministry of Environment (MOE). Both projects were ended in 2003, producing about 250 LCI modules. Korea is now in the second phase of the LCI database projects; as of 2004, MOCIE and MOE have been updating the existing LCI databases as well as constructing additional LCI databases. As a result, Korea now has about 300 LCI modules which are being used for Korean Type III Environmental Declaration Program. From 2004, the Ministry of Construction and Transportation (MOCT) initiated the 3-year project to construct the national LCI databases mainly for the building & construction materials and processes. These databases will be used for the Green Building Certification Program (Hur 2006).

Taiwan

LCA programs in Taiwan have been underway during the past 10 years. The wide range of activities includes a multi-year project being conducted by the Industrial Technology Research Institute (ITRI) to develop an LCI database (Sagi-

saka 2002). This project is funded by the country's Ministry of Economic Affairs. LCI efforts at ITRI through the year 2000 resulted in a substantial inventory of domestic LCI data, although as of December 2000, no critical peer review of the data had taken place (van Hoof et al. 2001). The basic data and the results are available on the internet for access by the public. An LCA forum was organised by ITRI to share information, identify the gaps, build consensus among public and private sectors, and co-ordinate development efforts on LCA in the country (Sagisaka 2002). ITRI has also developed an LCA software system named 'Do-It-Pro' for the Taiwan domestic users (Jeng 2004).

India

The Indian Society for Life Cycle Assessment (ISLCA) has been active for the past several years. The goal of the Society is to build capacity and interest in LCA within India (Inaba and Grant 2003).

Thailand

LCA was introduced to the Thai industries in 1997. An LCA forum named 'Thai LCA Network' was established by Chiang Mai University (CMU). The first formal LCI study was conducted by Thailand Environment Institute (TEI) in 2000 to develop LCI for Electricity Grid Mixes. Several LCI, LCA projects have been conducted by Cleaner Technology Advancement Program under the National Metal and Materials Technology Center (CTAP/MTEC) in collaboration with many universities and TEI since 2000. In 2005, the Thai National LCI database project was established with the technical support from the Japanese Government through the Green Partnership Plan. MTEC is the core implementing organization of this 3-year project with the support from several partner organizations such as the Federation of Thai Industry (FTI), Petroleum Institution of Thailand (PTIT), TEI, Ministry of Industry (MOI), Ministry of Natural Resources and Environment (MONRE), etc. (Sampattagul 2006).

Other

In China, institutions and academia are conducting LCA-related research, with an emphasis on environmental evaluations of waste recovery options and energy systems (Nie and Zuo 2003). A project, 'Research on Materials Life Cycle Assessment', supported by the National R&D program, has been underway for some time, and a National LCA Centre was established (AIST 2004). A national database is being developed in China. In Malaysia work is being done to develop LCI data for electricity production (Malakul 2005). Activity in LCA is taking place at several universities in Vietnam, and the Federal Government has commissioned several LCA studies beginning in 1999 (Inaba and Kabayashi 2000). Input-output LCA is being conducted at the National University, Ho Chi Min City, and the Open University has a team working on process-based LCAs. Case study topics include energy systems, waste management systems, and an oil product. Some case studies have been carried out in Singapore, however the use of LCA is not yet widespread.

The government established the Environmental Management Standards Committee, which formed a focus group on LCA, discussing all aspects of LCA. The members are from the Ministry of Environment, Universities and National Research Institutes, as well as from industry (Sagisaka 2002). Some case studies have been carried out in Indonesia, following national workshops introducing LCA to the country (Sagisaka 2002).

Europe

As the 'power-house' of LCA since the late 1980's, many different databases and data sources have been developed in Europe over the years. There are many university-based and consultancy-based databases which characterize particular industrial sectors and product groups. These are generally very diverse and fragmented, with a poor level of harmonisation, due to the many countries and many actors (industry, research, public authorities, etc.) involved. For countries such as Germany, Sweden, and Switzerland, which have been active in LCI data development for a number of years, the current challenge is one of integrating and ensuring comparability and interchangeability of a wide variety of LCI databases.

Germany

The German network on LCI data was initiated in 2001 as a joint effort with the federal government in order to provide continuously updated and reviewed LCI data sets. The European Concerted Research Action – 'Sustainable Materials Technology – Life Cycle Inventories for Environmentally Conscious Manufacturing Processes', is an open framework for European co-operation in the field of LCA with more than twelve European countries participating, scheduled to last until June 2006. The main objective of this action is to bridge the gap between fundamental LCA research and the needs of industry for an operational framework and model.

Sweden

In 1996, the establishment of a quality reviewed Swedish national LCA database was started within the Swedish national competence center CPM (Center for Environmental Assessment of Product and Material Systems) (Carlson and Pålsson 2000). The database, named SPINE@CPM, was launched to the public in 1998, and has since then been available through the Internet. All datasets published through the database are well-documented, and have been manually reviewed with regard to transparency and understandability.

Switzerland

Swiss LCA activities intensified during the 1990's, in particular with the LCI data reference work on energy systems, material supply, transport and waste management services (Frischknecht et al. 1996). In the year 2000, the main LCA research institutes in the ETH domain and Swiss Federal Offices founded the ecoinvent Centre, the Swiss Centre for Life

Cycle Inventories, which established an LCI database that covers commodities that are frequently used in LCA studies (ecoinvent Centre 2005). Transparent reporting is one of the key characteristics of the Swiss LCI database.

Other

Various European organisations and initiatives have facilitated exchange of LCA information over the years (e.g., SETAC-Europe, LCANET, CHAINET, etc.). A first attempt to facilitate the exchange of LCI data was done by SPOLD (Society for the Promotion of Lifecycle Development), which worked to develop a common format for the exchange of life-cycle inventory data (2.-0 LCA Consultants). In the beginning of this century the EcoSPOLD format was developed starting from SPOLD 99 and the ISO/TS 14048 data reporting format. Most commercially available LCA software (in particular CMLCA, EMIS, GaBi, KCL-eco, Regis, SimaPro, TEAM, and Umberto) are now able to import and partly even to export EcoSPOLD files. Most of the European databases that have been developed are only available through one of the many LCA software programs available (usually for a fee), with relatively few databases provided on a national, publicly available basis (see Table 3).

In its communication on Integrated Product Policy (COM (2003)302), the European Commission concluded that Life Cycle Assessments provide the best framework for assessing the potential environmental impacts of products currently available. In the document, the need for more consistent data and consensus LCA methodologies was underlined. It was therefore announced that the Commission will provide a platform, called The European Platform of Life Cycle Assessment, to facilitate communication and exchange of life-cycle data and launch a co-ordination initiative involving both ongoing data collection efforts in the EU and existing harmonisation initiatives. The Platform is planned to provide quality assured, life cycle based information on core products and services as well as consensus methodologies. The project started in mid-2005 and is planned to run until mid-2008 (European Union 2006).

Americas

Canada. The Canadian Raw Materials Database project was begun over 10 years ago, although it was only made publicly-available from 2001 until 2004. The database contains life cycle inventory cradle-to-gate data for basic materials, as provided by industry associations and their contractors. The data reflect as closely as possible Canadian production, except that in some cases the Canadian data have been averaged with US production data in order to protect proprietary information concerning Canadian suppliers. The materials covered include steel (EAF and integrated), aluminium, six separate plastics, glass (recycled and virgin), paper, and softwood lumber. The data were available in pdf format at no cost to the public. The website is still online but it has not been possible to access the data since 2004. The continuation of the project has not been determined.

USA. LCI data is available from a fair number of sources in the USA, from work done at various universities and research organisations, and by various government departments, consultants and industry organisations. However, not until 2001 was a collaborative project to develop a publicly available LCI database for the USA realized (more specifically, the database contains cradle-to-gate or gate-to-gate data that can be used in completing an LCI). This project received start-up funding from the General Services Administration (GSA) and the US Department of Energy (DoE), and the database is hosted by the National Renewable Energy Laboratory (NREL). The data, a user guide and project development guidelines can be downloaded from their website (National Renewable Energy Laboratory 2006). There are currently 73 data modules in the NREL database that are available for downloading.

Latin America. There is much activity now occurring in Latin America on LCA. An LCI database development project for Argentina was launched at the Universidad Tecnologica Nacional (Mendoza), but due to the present economic situation in Argentina, there is no current funding for the project (Curran et al. 2005). In Chile, work is being done to develop electricity data representative of Chilean conditions.

Professor Armando Caldeira Pires and his team are developing a Brazilian database, as well as conducting a South American project to develop a standardized LCI database for metals (although Mexico is not receiving funds for this project they are also participating). Colombia has also started a national LCI database. Mexico also started database development, first funded and helped by AIST in 2002, for electricity and metals, and then continued with other important sectors such as fuels, chemical substances, some building materials and waste treatment. Last year the Mexican Center for LCA and Sustainable Design was started; the Center now manages the databases, and is working together with government and industry to officially launch a project which will allow the database to grow (Suppen 2006).

Summary Tables

The LCI data resources are summarised in the report in a series of tables. One table provides an overview of the global spread of LCI data resources, and essentially provides a top-level summary of the subsequent tables (Table 1, see p. ##), whilst another lists LCA societies and networks (Table 2, see p. ##). Other LCI databases are listed in the report in four tables, including national database projects, industry databases, other data sources, and LCA software (combined highlights of this information are presented here in Table 3, see p. ##). The tables in the report provide additional information, such as contact names. The report's appendix is comprised of brief summary paragraphs of the industry/proprietary databases which were requested from representatives of the database projects, or taken from information sent by the representative with the 'call for interest'. If not supplied directly, information that is available via the internet from a source's respective website was used.

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Table 1: Global activity in the production of LCI data

Level of Participation	Africa	APEC	Europe	Americas	Global
Multi-organisational and/or National or Multigovernment ¹		Australia, Japan, Korea, Singapore, Taiwan	Denmark, Sweden, Switzerland	Canada, USA	
Consultants and Research Institutes (data made available) ²			Denmark, Netherlands, Norway, Sweden, Switzerland, Germany, Italy	USA	Boustead, TEAM, GaBi, SimaPro
Industry (data made available) ³		ISSF	PlasticsEurope (formerly APME), FEFICO, ISSF, Volvo, EPD-Norway, EAA	International Stainless Steel Forum, American Plastics Council	International Iron and Steel Institute, Nickel Institute
Decentralized (academic, consultants etc.) ⁴	Egypt, Mauritius, South Africa	China, India, Indonesia, Malaysia, Philippines, Thailand, Vietnam	Norway	Brazil, Chile, Colombia, Mexico	

¹ Co-ordinated effort to produce nationally representative and accessible database. Typically involves collaboration between several organisations and some degree of government funding.

² Inventories produced by research organisations or consultants and made publicly available in a database, most often for a fee (e.g. databases included with LCA software).

³ Inventories produced and published under the auspices of a particular industry organisation. Includes cases where data made only partially available (e.g. for a fee, or only to parties with sufficient motivation for requesting the data). Most often data compiled by consultants, but includes cases where LCI development is done in-house, or by academic or other research organisations.

⁴ Includes inventories compiled by academic or other research organisations, made either partially or fully available on an ad-hoc basis (e.g., through journal publications). Countries may have some degree of information sharing (e.g. an LCA society), but no co-ordinated data gathering effort (i.e. studies are not organised into an accessible database).

Table 2: LCA organisations

Region	Name	Website
Africa	African LCA Network (ALCANET)	http://ciclo-cycle.obiki.org/net/ALCAN.html
America	American Center for LCA (ACLCA)	www.lcacenter.org
APEC	LCA Researcher's Network for APEC Member Economies (APLCANET)	http://unit.aist.go.jp/lca-center/asianetwork/top.htm or http://aplcanet.rmit.edu.au/
Australia	Australian Life Cycle Assessment Society (ALCAS)	www.alcas.asn.au
Canada	CIRAI	http://www.polymtl.ca/cirraig/
Denmark	LCA Center Denmark	www.lca-center.dk
India	Indian Society of LCA (ISLCA)	members.tripod.com/neef.in/islca.html
Japan	LCA Society of Japan (JLCA)	www.jemai.or.jp/lcaforum/
	Research Center for LCA	http://unit.aist.go.jp/lca-center/english/top.htm
	The Institute of LCA, Japan	http://ilcaj.sntt.or.jp/ (Japanese)
Korea	Korean Society for LCA (KSLCA)	kslca.com (Korean)
	LCA Research Center (LCARC)	http://www.lcarc.re.kr/English/
Latin America	Association of LCA in Latin America (ALCALA)	http://www.scientificjournals.com/sj/lca/Pdf/aid/7637
Mexico	Mexican Center for LCA and Sustainable Design	http://www.lcamexico.com
Philippines	Plans are to establish a network of academic, government, and other organisations by late 2006	
Sweden	Center of Environmental Assessment of Product and Material Systems (CPM)	http://www.cpm.chalmers.se
Thailand	Thai LCA Network	http://www.thailca.net

Table 3: Global sources of life cycle inventory

National LCI Databases				
Name	Website	Availability	Focus	Region
Australian Life Cycle Inventory Data Project	http://www.cfd.rmit.edu.au/programs/life_cycle_assessment/life_cycle_inventory	Free		Australia
BUWAL 250	http://www.umwelt-schweiz.ch/buwal/eng/	Fee or included with SimaPro	Packaging materials	Switzerland
Canadian Raw Materials Database	http://crmd.uwaterloo.ca/	Free	Raw materials	Canada
DuboCalc	http://www.rws.nl/rws/bwd/home/www/cgi-bin/index.cgi?site=1&doc=1785	Upon request	Construction materials	Netherlands
Dutch Input Output	www.pre.nl	Licence fee	Input-output	Netherlands
ecoinvent	www.ecoinvent.ch	Licence fee		Global/ Europe/ Switzerland
Eco-Quantum				
EDIP	www.lca-center.dk	Licence fee		Denmark
Franklin US LCI	www.pre.nl	Available with SimaPro		U.S.A
German Network on Life Cycle Inventory Data	www.lci-network.de	On-going		Germany
ITRI Database	http://www.itri.org.tw			
IVAM LCA Data	www.ivam.uva.nl	Licence fee	Construction, food, waste, etc.	Netherlands
Japan National LCA Project	http://www.jemai.or.jp/lcaforum/index.cfm (in Japanese) http://www.jemai.or.jp/english/lca/project.cfm	Fee		Japan

Table 3: Global sources of life cycle inventory (*cont'd*)

National LCI Databases				
Name	Website	Availability	Focus	Region
Korean LCI	http://www.kncpc.re.kr	On-going		
LCA Food	www.lcafood.dk	Free	Food products	Denmark
SPINE@CPM	www.globalspine.com	Fee		Global
Swiss Agricultural Life Cycle Assessment Database (SALCA)	www.reckenholz.ch/doc/en/forsch/control/bilanz/bilanz.html	Free with contact	Agriculture	Switzerland
Thailand LCI Database Project	www.mtec.or.th			Thailand
US LCI Database Project	www.nrel.gov/lci	Free with contact		US
Industry Organisation Databases				
American Iron and Steel Institute (AISI)			Iron and steel	America
American Plastics Council (APC)			Polymers	America
EDP-Norway	www.epd-norge.no	Free	Norwegian business (several sectors)	Norway and Europe
European Aluminium Association (EAA)	www.aluminium.org	Free	Aluminium	Europe
European Copper Institute (ECI)	www.copper-life-cycle.org	Free with contact	Copper	Europe
European Federation of Corrugated Board Manufacturers (FEFCO) Groupement Ondulé, European Association of Makers of Corrugated Base Papers (GEO) European Containerboard Organisation (ECO)	www.fefco.org	Free	Corrugated Board	Europe
International Iron and Steel Institute (IISI)	www.worldsteel.org	Free with contact	Steel	Global
ISSF International Stainless steel Forum (ISSF)	www.worldstainless.org/	Free with contact	Stainless steel	Global
KCL (EcoData)	http://www.kcl.fi/eco	Fee	Pulp and paper	Finnish/Nordic
Nickel Institute	http://www.nickelinstitute.org/index.cfm/ci_id/114.htm	Free with contact	Nickel	Global
PlasticsEurope (formerly APME)	www.plasticseurope.org	Free	Plastics	Europe
Volvo EPDs	http://www.volvo.com/group/global/en-gb/Volvo+Group/ourvalues/environmentalcare/products/products.htm	Free	Trucks and busses	Europe
Other Sources of LCI Data				
Group of Pollution Prevention (GP2), Chemical Engineering Department, University of Sao Paulo				Brazil
Østfold Research Foundation	www.sto.no			Norway and Europe
SINTEF Byggforsk (The Norwegian Building Research Institute)	http://www.byggforsk.no/default.aspx?spraak=en			Norway
LCA Software				
BEES 3.0	http://www.bfrl.nist.gov/oae/software/bees.html	Free with contact	Building materials and products	USA
Boustead Model 5.0	http://www.boustead-consulting.co.uk/products.htm	Licence fee		Global
CMLCA 4.2	http://www.leidenuniv.nl/interfac/cml/ssp/software/cmlca/index.html	Licence fee only for commercial use		Europe
eiolca.net	www.eiolca.net	Free	Input-Output	USA
EMIS	www.carbotech.ch	Licence fee		Global
Environmental Impact Estimator	http://www.athenasmi.ca/tools/	Licence fee	Building materials and products	Canada, USA
GaBi	http://www.gabi-software.com/	Licence fee		Global
GEMIS	http://www.oeko.de/service/gemis/en/index.htm			Europe
GREET 1.7	http://www.transportation.anl.gov/software/GREET/index.html	Free	Transportation sector, energy sector	USA
IDEMAT 2005	http://www.io.tudelft.nl/research/dfs/idemat/index.htm	Licence fee	Engineering	Netherlands
KCL-ECO 4.0	http://www.kcl.fi/eco	Licence fee		Global
LCAiT	http://www.lcait.com/	Licence fee		
MIET	http://www.leidenuniv.nl/cml/ssp/software/miet/index.html			
AIST-LCA (JEMAI-LCA)	http://unit.aist.go.jp/lca-center/english/theme.html	Licence fee to JEMAI		Japan
Regis	www.sinum.com	Licence fee		Global
Simapro 7	www.pre.nl	Licence fee		Global
TEAM	http://www.ecobalance.com/uk_team.php			Global
Umberto	www.umberto.de	Licence fee		Europe